Amendments to the Drawings:

The attached sheets of drawings include changes to Figs. 1, 2, 3a-c and 7a-7j. The sheets replace the original sheets.

Attachment: Replacement Sheets
Annotated Sheets Showing Changes

REMARKS

In view of both the amendments presented above and the following discussion, the Applicants submit that none of the claims now pending in the application is obvious under the provisions of 35 USC § 103. Thus, the Applicants believe that all of these claims are now in allowable form.

If, however, the Examiner believes that there are any unresolved issues requiring adverse final action in any of the claims now pending in the application, the Examiner should telephone Mr. Peter L. Michaelson, Esq. at (732) 542-7800 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Specification amendments; abstract

The Examiner objected to the specification, as filed, due to a lack of proper formatting. In response, the Applicants have enclosed a substitute specification in the proper format. Also, various amendments have been made to the specification to correct minor inadvertent grammatical, punctuation and formal errors. Though all these amendments are shown above for the Examiner's convenience, they are all included in the substitute specification. None of these amendments constitutes new matter.

The Examiner has also objected to the Applicants' abstract, as filed, inasmuch as it was not provided on a separate sheet. In response, the Applicants have enclosed a substitute abstract on a separate sheet. The substitute abstract also removes reference numerals and corrects other

minor errors that appeared in the abstract, as filed. None of these changes constitutes new matter either.

Accordingly, these objections should now be withdrawn.

Drawings

The Examiner has objected to the Applicants' drawings, as filed, owing to various informalities.

First, the Examiner notes that reference numerals "2", "4" and "5" have apparently been used to designate the same element in FIG. 1, and reference numerals "1" and "2" have been used to designate the same part on FIG. 2. In response, the Applicants propose to correct FIGs. 1 and 2 to eliminate such multiple references, thus both clarifying and simplifying these figures.

The Examiner also noted that reference numerals "9" and "10" have apparently been used to designate the same element in FIG. 7J. Element 10 references a central overlapped portion of image 9 -- in the same fashion as does reference numeral 10 refer to a overlapped portion of image 9 in FIG. 6e. Reference numeral 9, depicted in FIG. 7J, refers to that entire image. To adequately point to and thus differentiate the different elements or portions thereof to which reference numerals "9" and "10" refer, the Applicants propose to extend the associated lead lines and add arrowheads to those lines.

The Examiner has also required the Applicants to label FIGs. 1-3C as prior art in order to conform these figures to the specification. The Applicants have now done so.

To facilitate correction of the drawings and entry of the substitute sheets, the Applicants have enclosed red-lined drawing sheets which provide their proposed corrections to FIGs. 1, 2, 3A-3C and 7J, and substitute drawing sheets for these figures that incorporate all these changes. The Applicants now solicit the Examiner's approval of all these changes.

Given these corrections, the drawing objections should also now be withdrawn.

Status of claims

Rather than re-writing the claims to include numerous changes, the Applicants have simply canceled their prior claims 1-12 and replaced them in their entirety with new claims 13-24. The new claims provided enhanced clarity, more precisely define the invention than did the prior claims, and also conform to proper US claim practice. The correspondence between the current and prior claims is given in the following table:

Pending claim	Prior claim	Pending claim	Prior claim
13	1	19	7
14	2	20	8

15	3	21	9
16	4	22	10
17	5	23	11
18	6	24	12

Claim objection

The Examiner has objected to claims 1-12 due to various informalities, including numerous grammatical and syntax errors, and thus required appropriate correction.

As noted above, new claims 13-24 have been drafted to conform to the dictates of proper US claim practice. Doing so has eliminated various errors including those in grammar and syntax. Further, these new claims do not recite "the at least part" -- a specific informality which the Examiner noted in the prior, now canceled, claims.

Hence, this objection should also be withdrawn.

Rejection under 35 USC § 103

The Examiner has rejected claims 1-12 as being obvious, under the provisions of 35 USC § 103, over the teachings in the Brunner et al application (United States patent application publication number 2002/0093516 published on July 18, 2002) in view of those in the Kuroda et al application (United States patent application publication number 2004/0008156 published on January 15, 2004). Inasmuch as claims 1-12 have now been canceled, this rejection is moot. Nevertheless, since these claims have been replaced by new claims 13-24 with claims 19-24 being

method claims counterpart to apparatus claims 13-18 (similar to prior method claims 7-12 being counterpart to prior apparatus claims 1-6), the Applicants will address this rejection in the context of new claims 13-24 and principally with respect to new independent apparatus claim 13. In that context, this rejection is respectfully traversed.

The Examiner is of the view that all the limitations of prior claim 1 are disclosed in the Brunner et al application but with one exception. In that regard, the Examiner concedes that that application fails to disclose the feature of a light source where the source is parallel to at least one of the image screens and the viewing axis is perpendicular to the light source. Given that omission, the Examiner turns to the Kuroda et al application for the missing teachings. The Examiner concludes, inasmuch as both of those cited applications address a multi-layer imaging system, that "one of ordinary skill in the art at the time of the present invention would combine the flexible translucent multi-layer display system of Brunner with the light source and view post of Kuroda" and thus arrive at the Applicants' present invention as then recited in prior claim 1. As the Examiner will soon appreciate, his view is incorrect with respect to new independent claim 13 (and 19).

Prior to discussing claim 13 in detail, it bears expressly emphasizing at the very onset that while both the present invention and that disclosed by the Brunner et al application are directed to the display of multi-level images, they disclose two entirely different approaches for doing so.

Specifically and as shown in FIG. 1 and discussed in, e.g., paragraph [0028] et seq, the Brunner et al application is directed to a computational approach where transparency (alpha) and color values of corresponding pixels of the input layers 103 are accumulated (though the accumulation stops, for any pixel, should it reach a maximum value of opacity for that particular pixel), through accumulator 102 situated within graphics processor 101, using a compositing method, to yield a single value that is loaded into a corresponding pixel position in a frame store memory. In one embodiment, this process is repeated on a pixel-by-pixel basis (at least for those pixels which will contribute to the final image) to fully populate a resulting image in frame store. The resulting image stored in the frame store is then displayed on a single display screen 105. This operation is expressly described in paragraphs [0038] and [0039] on page 3 as follows:

> "In one embodiment, the invention reads pixel data from layers 103 in a top-down order, with the topmost layer 103 being accumulated first. As each pixel's data is read, it is merged with the current value of accumulator 102 using a compositing method ... [T]he invention accumulates alpha values as well as color values. If the accumulated alpha value indicates full opacity before all layers 103 have been processed, processing for the current pixel may be terminated, since any layer 103 beneath the current layer would be completely obscured by the layers 103 that have already been processed. ...
>
> Once the invention has read all layers 103 that may contribute to pixel 301, or once full opacity has been reached, the value in accumulator 102 is output.

In one embodiment, the value is written directly to frame buffer 104."

This operation is shown in flowchart form in FIG. 6.

In stark contrast, the present invention relies on a totally different approach. Rather than mathematically computing a resulting value for each and every pixel in a displayed multi-layered image -- as taught by the Brunner et al application, the present invention relies on forming and displaying separate specific images, each on a separate translucent display screen, and in particular in specific alternating but synchronized states across the images, and then optically overlapping these images to form a composite image that is ultimately viewed. The screens are positioned substantially parallel to each other with one situated behind the other, with a common viewing axis running through the screens. A light source is situated on one end of the axis, while a viewpoint is situated at the other end, with the screens being oriented substantially perpendicular to the axis and located between the light source and the viewpoint. Each of the separate images, or portions thereof, can be separately displayed on its corresponding display screen in one of three states: transparent, normal appearance or occluded (opaque). In a basic embodiment of the invention, two such separate images are formed on two separate translucent display screens. One display screen is controlled to display its image, or at least a portion thereof, on an alternating basis between the transparent state and a normal appearance state. The other screen is similarly controlled to display the second image on an alternating basis between the occluded state and a normal

appearance state. Both the display screens are further controlled to alternate their respective images in a synchronized fashion with each other, specifically the normal appearance of the first image occurs simultaneously with the occluded state of the second image and the transparent state of the first image occurs simultaneously with the normal appearance of the second image. Doing so yields a properly overlapped composite image to a viewer situated at the viewpoint and viewing an image displayed on the closest display screen. See, the present specification at e.g., page 2, line 26 through page 3, line 18 and, in conjunction with FIGs. 4A-4E, page 10, lines 6-29.

As the Examiner can now appreciate, the Applicants' present invention employs a widely divergent approach from that taught by the Brunner et al application to attain the same overall result: a properly displayed multi-layer image.

With this backdrop in mind, the Applicants will now discuss each limitation in new independent claim 13 corresponding to the Examiner's approach through which he discussed each such corresponding limitation in prior claim 1, and will specifically show why that limitation in claim 13 is not present, taught or even suggested in the Brunner et al application.

a) *"A multi-layer display for displaying overlapping images, the display comprising"*

The Examiner believes that this limitation is found in paragraph [0032] of the Brunner et al application

where three layers 103 are mentioned (also see FIG. 3). This is not the case.

The Brunner et al application does not concern display hardware but rather, as discussed above, addresses calculations on image pixel data and particularly a methodology of calculating pixel data that is faster than conventional techniques. The motivation for doing so is to reduce the number of needed calculations in view of the video display (frame) rate.

Calculating the ultimate (flat) image is not related to the present method of combining physically separated depth layers by temporally alternating the layer contents, in a synchronized fashion across the separate images -- one for each such layer, with the resulting images then being effectively optically combined.

The Brunner et al application, thus, relates to a *single-layer* display (see [0028] on page 2) for displaying overlapping layers (with "virtual images" solely existing in software) of an image on a single 2-dimensional display. Claim 13 instead relates to a *multi-layer* display for displaying overlapping (real) images using multiple, spatially separated, image display screens.

Although the Brunner et al application conceptually refers to the layers of the image as being stacked (see paragraph [0037]), the final resulting image that is displayed on a single display screen, i.e. display 105 (see FIG. 1), is one single flat image.

b) *"a first translucent image screen, placed substantially perpendicular to a viewing axis from the light source, for displaying a first image having at least one of a color, grey tone and a pattern"*

Here the Examiner refers to paragraphs [0013] and [0029] of the Brunner et al application which describes that the layer displayed on the screen may have translucent *regions*. This, however, does *not* mean that the image screen itself has to be translucent -- as is the case in the present invention. That application further explains that a layer "on top" of another layer may be displayed as being translucent with respect to the lower layer. This result, of course, may also be attained if the lower layer, or even the screen itself is opaque.

Hence, the Brunner et al application fails to disclose a first translucent image screen.

c) the *first translucent image screen "for displaying the first image in one of a transparent state, a normal appearance state and an occluded state, the viewing axis extending from the light source through the first image screen to a viewpoint"*

The Brunner et al application does not mention displaying an image in an occluded state. If an object in one layer is positioned "underneath" an object in another layer, that object will be obscured in the final image and hence simply not displayed. However, not displaying an image is not the same as displaying an image in an occluded state. In the latter case, according to the

present invention, the image is in fact displayed on one of the screens, but its appearance is modified to the occluded state, for instance in black (see page 4, lines 11--14 of the present specification, i.e., the Applicants' published PCT application). The Brunner et al application does not display such a black image.

d) *"a second translucent image screen placed substantially perpendicular to the viewing axis and located between the first image screen and the viewpoint, with the viewing axis extending through the second image screen and spatially separated from the first image screen, and oriented substantially parallel to and overlapping with the first image screen, the second image screen for displaying a second image, having at least one of a color, grey tone and a pattern,"*

The Brunner et al application simply does not disclose a first translucent image screen and a second translucent image screen, particularly in the specific orientation recited in this limitation. That application has no teachings whatsoever of employing multiple separate display screens, let alone with each being translucent. In fact, such a teaching directly contradicts the express teaching in that application of using a single display screen 105 as shown in FIG. 1. In that regard, paragraph [0028] of that application recites in pertinent part: "[S]ystem 100 is implemented on a conventional personal computer having a central processing unit and/or graphics processor 101 and a *display* 105, such as a cathode ray tube (CRT) or liquid crystal display (LCD) *device*." [emphasis added]

e) the *second translucent image screen "for displaying the second image in one of the transparent state, the normal appearance state and the occluded state"*

As discussed above with respect to the limitation for the first translucent image screen, the Brunner et al application fails to teach the concept of displaying an image in an occluded state.

f) *"wherein the first image screen is controlled to alternate at least part of the first image between the transparent state and the normal appearance state"*

Here, the Examiner views paragraphs [0029]-[0033] and [0083]-[0100] of the Brunner et al application as apparently disclosing the concept of alternating between a transparent state and a normal appearance state. This view is simply incorrect.

Layers 103 shown in that application are depicted from foreground to background but are not separately displayed as such on separate display screens, let alone in an alternating fashion between the screens. Nor can they be inasmuch as that application only teaches the use of one single display screen which depicts a flat image, with the different layers being computationally, not optically, combined.

g) *wherein "the second image screen is controlled to alternate, synchronously with the first image screen, at least part of the second image between the occluded state and the normal appearance state, and the normal appearance state of the first image occurs simultaneously with the occluded state of the second image and the transparent state of the first image occurs simultaneously with the normal appearance state of the second image so as to produce an image for viewing at the viewpoint."*

Again, the Examiner refers to paragraphs [0029]-[0033] and [0083]-[0100] of the Brunner et al application as apparently disclosing the concept of alternating between an occluded state and a normal state appearance. Besides the fact that that application does not disclose the use of multiple separate image screens, nor displaying images in an occluded state, that application does not disclose, suggest or teach that one of the layers alternates between an occluded state and a normal state appearance. Even if in that application, an upper layer may obscure a lower layer, the lower layer is not modified to and displayed in an occluded state -- which the present Applicants teach, rather the lower layer is simply not displayed at all.

So, as the Examiner can surely appreciate, the teachings of the Brunner et al application fall far short of disclosing, teaching or even just suggesting any of the cited limitations in new independent claim 13.

Does the Kuroda et al application disclose, teach or suggest any of the relevant teachings missing from the Brunner et al application? No.

Specifically, the Kuroda et al application describes a multi-layer display and a method for displaying three-dimensional images by modulating brightness of an image on front and rear screens. That application appears to teach that an image is simultaneously displayed on the front and rear screens in an overlapping fashion, while the relative brightness of the image displayed in those screens determines the observed position of the image (see paragraphs [0074] and [0075]). That patent further describes that when the two images are shown in a spaced relationship, these images may alternately be shown (see paragraph [0076]). However, that application however does not explain how to handle situations when one image is positioned (partially) behind the other image. Further, that application does not describe the concept of displaying one of the images in an occluded state.

Hence, if the teachings of the Kuroda et al application were incorporated into those of the Brunner et al application -- as the Examiner generally implies, then the resulting combination would still fall far short of disclosing, teaching or suggesting, even implicitly, the present invention as recited in claim 13.

Independent claim 13 of the present application contains suitable recitations, as discussed above, which are clearly directed to the distinguishing aspects of the present invention. In particular, this claim recites as

follows, with those distinguishing recitations shown in a bolded typeface:

"**A multi-layer display for displaying overlapping images, the display comprising:**

a light source;

a first translucent image screen, placed substantially perpendicular to a viewing axis from the light source, for displaying a first image having at least one of a color, grey tone and a pattern, and displaying the first image in one of a transparent state, a normal appearance state and an occluded state, the viewing axis extending from the light source through the first image screen to a viewpoint; and

a second translucent image screen placed substantially perpendicular to the viewing axis and located between the first image screen and the viewpoint, with the viewing axis extending through the second image screen and spatially separated from the first image screen, and oriented substantially parallel to and overlapping with the first image screen, the second image screen for displaying a second image, having at least one of a color, grey tone and a pattern, and displaying the second image in one of the transparent state, the normal appearance state and the occluded state; and

wherein the first image screen is controlled to alternate at least part of the first image between the transparent state and the normal appearance state and the second image screen is controlled to alternate,

synchronously with the first image screen, at least part of the second image between the occluded state and the normal appearance state, and the normal appearance state of the first image occurs simultaneously with the occluded state of the second image and the transparent state of the first image occurs simultaneously with the normal appearance state of the second image so as to produce an image for viewing at the viewpoint."
[emphasis added]

New independent method claim 19, which is counterpart to claim 13, contains highly similar distinguishing limitations to those appearing in claim 13.

Hence, the Applicants submit that neither of these two independent claims is rendered obvious by the teachings of the Brunner et al and Kuroda et al applications, regardless of whether those teachings are taken singly or any combination, including that posed by the Examiner. Consequently, both of these claims are patentable under the provisions of 35 USC § 103.

Each of claims 14-18 and 20-24 directly or indirectly depends from independent claim 13 or 19, respectively, and recites a further distinguishing aspect(s) of the present invention from those recited in its corresponding independent claim. As such, the Applicant submits that each of claims 14-18 and 20-24 is also not rendered obvious by the teachings of the Brunner et al and Kuroda et al applications for the same reasons set forth above with respect to independent claim 13. Consequently,

each of dependent claims 14-18 and 20-24 is also patentable under the provisions of 35 USC § 103.

Accordingly, this rejection should also now be withdrawn.

Conclusion

Consequently, the Applicants believe that all the pending claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

Respectfully submitted,

April 27, 2009

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